

relatively minor part of the book before us. Vocational selection, for example, is treated very briefly and, on the whole, rather slightly. This is really the only serious blemish on a valuable piece of work, a blemish which is scarcely removed by a promise in a footnote to deal with the subject of vocational selection in another book to be published shortly. This defect is, however, in our opinion, compensated by the very interesting discussion from a psychological point of view of some of the larger and more pressing problems of labour, beginning with chap. v. on "Scientific Management and Labour," and continued in chap. vi. on "Industrial Unrest," the most important chapter in the book.

Mr. Watts has made a serious and, on the whole, very successful attempt to apply the newer psychology of human tendencies and emotions—the psychology of McDougall, Trotter, Freud, and Jung—to the conditions and problems of industrial life. The attempt is all the more deserving of attention because it is the most elaborate attempt that has hitherto been made, in this country at least, though Myers, Muscio, and Tead have all made pioneer journeys into this field. The use made of the Freudian psychology to interpret the phenomena of social unrest is particularly noticeable. The analogy between the individual and society is a very old one, but this is the first attempt we have come across to work out the analogy in any detail in the sphere of psychopathology. It need scarcely be said that due caution must be exercised in such an undertaking, and that the analogy easily breaks down if it is pressed. Nevertheless, Mr. Watts must be congratulated on the skilful manner in which he has carried out a difficult task, and the very important and suggestive results to which he has been led.

Early in the book the author points out that there has been, and is still, a good deal of scepticism about the practical possibilities of psychology, more especially, perhaps, in the sphere of industry. In his opinion this scepticism is due largely to the fact that the psychologist has been "too frequently unwilling to quit the enclosures of a narrow specialism, and adventure into the fields of public controversy, there to pass judgment in his own way on current tendencies in art, religion, industry, and politics." This aloofness from the concerns of practical life can no longer be charged against the psychologist. All kinds of significant developments are taking place at the present time in every direction of practical activity, pointing to a growing appreciation of the practical significance of psychology; but surely the charge against the psychologist is an error.

The psychologists of an earlier day, in this as in other countries, have been as ready to express their opinions on the questions of the day as have the representatives of the physical sciences. The real reason for the scepticism is that the older psychology was not capable of throwing any very clear or definite light on practical problems, and practical men are only now beginning to be convinced that the newer psychology is in a somewhat different position. Books like that of Mr. Watts's will give a strong stimulus to the spread of this conviction. From this point of view it is of quite exceptional interest and importance.

J. D.

History of Science in Edinburgh.

Edinburgh's Place in Scientific Progress. Prepared for the Edinburgh Meeting of the British Association by the Local Editorial Committee. Pp. xvi+263. (Edinburgh and London: W. and R. Chambers, Ltd., 1921.) 6s. net.

THE British Association handbook which has been prepared by the Local Editorial Committee differs entirely in scope from what has usually been offered to the members of the Association. With the present high cost of printing it was early decided that it was practically impossible to give anything like a satisfactory presentation of the city as regards its history, its public services, its educational, industrial, and commercial life, and its general plan and architecture, as well as the customary details of the botany, natural history, and geology of the surrounding region. Such a glorified guide-book seemed scarcely called for in a city like Edinburgh, about which so much literature already exists. There is, however, one aspect of Edinburgh life which, as a whole, has been neglected in the many books which have been written concerning the capital of Scotland, and this is the aspect which should appeal especially to members of an Association the aim of which is the advancement of science. It is briefly expressed by the title, "Edinburgh's Place in Scientific Progress."

In this small volume of 263 pages we find a comprehensive epitome of what has been done by Edinburgh men and men trained in Edinburgh schools towards the advancement of science in all its recognised branches. No fewer than twenty-five authors have contributed to the work, each dealing with his or her appropriate section. Of these the majority are connected with the university, either as graduates or members of the teaching staff. A brief glance at the contents will suffice to show the nature of the book.

Section 1, on mathematics and natural philosophy, is by Dr. C. G. Knott, with subsections on astronomy by Prof. Sampson, actuarial science by Dr. A. E. Sprague, and meteorology by Mr. Andrew Watt. Here we find chronicled the important advances made by Napier, Gregory, Stirling, and Maclaurin in mathematics; by Leslie, Forbes, Balfour Stewart, Waterston, Tait, and Maxwell in experimental and mathematical physics; by Buchan in meteorology; by Dr. T. B. Sprague in actuarial science; and by Henderson in astronomy. In section 2 Dr. Dobbin treats of pure chemistry; Principal Laurie of industrial chemistry; and Mr. Steuart of the shale oil industry. Black, Rutherford, and Hope receive particular notice; the share the industrial chemists of Edinburgh took, and still take, in the production of certain important drugs is duly chronicled, and also the remarkable work of James Young in initiating the manufacture of paraffin. Section 3 is devoted to geology, and Messrs. E. B. Bailey and D. Tait, of the Scottish Geological Survey, tell the story of the pioneer work of Hutton, and bring down the record of the work done by Hugh Millar, Maclaren, Traquair, and the Geikies to quite recent days, when botanists and geologists mutually rejoice in the revelations of the fossils of the Rhynie chert.

In section 4, on engineering, Prof. Hudson Beare recounts Symington's early attempts to propel ships with steam power; tells of Nasmyth, of steam-hammer fame; and shows forth the labours of Robert Stevenson and his descendants in designing and building lighthouses and improving lighthouse illumination.

Section 5, zoology, is from the pen of Dr. James Ritchie, who brings out (what is further established by the later articles on botany, geography, and medicine) how greatly the study of natural history was fostered by the teachers and students in Edinburgh's medical schools. The most conspicuous names among these are Edward Forbes, Allman, Wyville Thomson, and Charles Darwin, who spent two years studying natural science at Edinburgh. Although largely a branch of zoology, oceanography is treated as a separate section, and in it Prof. Herdman (himself an Edinburgh graduate) traces the succession of oceanographical developments in Edinburgh through the life labours of Edward Forbes, Wyville Thomson, and John Murray, bringing the story down to W. S. Bruce's *Scotia* expedition and Murray's last voyage in the *Michael Sars*. Section 7, botany, is by Mr. W. W. Smith, of the Royal Botanic Gardens. It is interesting to note that the first chair of medicine in the uni-

versity was the chair of botany and medicine, and that the founding of this chair followed the institution of the "Medicine Garden," which ultimately developed into the Royal Botanic Garden. Of the many mentioned in connection with Edinburgh, the most conspicuous are Hope, Arnott, Hooker, Graham, Balfour, Robert Brown, and Dickson. A brief subsection on forestry, by Sir John Stirling-Maxwell, emphasises the strong lead taken by Edinburgh in the promotion of forestry as a science.

In section 8, on agriculture, Mr. J. A. S. Watson records the invention of the threshing machine by Meikle, of East Lothian, and the important work done by Shireff in the improvement of cereals. The Edinburgh chair of agriculture, founded in 1790, seems to have been the earliest in any country. Mr. G. G. Chisholm, in the article, "Geography," section 9, begins by giving an impressive list of travellers and explorers who, born or trained in Edinburgh, have notably extended geographical knowledge. A brief history is also given of the two well-known cartographical firms which have brought fame to the city. Section 10 deals with anthropology under the two headings of "Archæology," by Mr. J. H. Cunningham, of the Society of Antiquaries of Scotland, and "Physical Anthropology," by Prof. Robinson. The systematic excavation of ancient sites is now the great feature of archæological research, and the very recent discoveries at Traprain Law have excited great interest. On the other hand, the remarkable collection of skulls and skeletons now in possession of the university anatomical department has been only partially discussed by Turner, Cunningham, and others.

Section 11, on medicine and surgery, constitutes the largest of all the sections, and is the work of three authors, Dr. J. D. Comrie and Prof. Ritchie, treating of the Edinburgh Medical School, and Dr. Alexander Miles, who treats of surgery. The chairs of botany, natural history, and chemistry were all originally chairs in the medical faculty of the university, a fact which explains the valuable work done in pure science by leading Edinburgh physicians and others trained in the medical school; and the same keenness was shown down the centuries in the scientific study of anatomy, physiology, *materia medica*, and other branches of medical and surgical knowledge. The university professors and the teachers in the extramural school alike brought renown to their city as a great centre of medical training. *Monro secundus*, Charles Bell, Benjamin Bell, Sharpey, Goodsir, Christison, James Young Simpson, and Lister are a few of the many whose names are

familiar to the student of medicine. In a brief article on dentistry Dr. William Guy pointedly refers to the anatomist Goodsir for his early work on the development of the teeth.

Section 13, on political economy, is contributed by Prof. Nicholson, who leads up through the labours of Adam Smith's predecessors to Adam Smith himself, the great economic genius of all time, and then discusses the work of later economists, such as Macpherson and McCulloch. Dr. Drever supplies the articles on psychology and education, sections 14 and 15 respectively, in which David Hume, Dugald Stewart, the brothers Combe, Laurie, and Melville Bell find their appropriate places. Finally, in section 16, Miss Nora Milnes describes the social aspects of Sir Robert Philip's anti-tuberculosis dispensary movement and the important part played by Edinburgh authorities in child welfare schemes.

The whole record of scientific work as presented in these contributions to "Edinburgh's Place in Scientific Progress" is one of which any city may well be proud. The work done in Edinburgh and by Edinburgh men does not stand alone, but is closely linked with the labours of men of science in other lands, and it is one of the merits of the book that these international relations are skilfully touched upon by the several writers.

The book is illustrated by portraits of Napier, Black, Hutton, Nasmyth, Edward Forbes, Simpson, Lister, Adam Smith, and David Hume. Intended originally as a handbook for the members of the British Association meeting in Edinburgh, it is being published for general circulation by Messrs. W. and R. Chambers at the price of 6s. net.

An Electronic Theory of Valency.

The Electronic Conception of Valence and the Constitution of Benzene. By Prof. H. Shipley Fry. (Monographs on Inorganic and Physical Chemistry.) Pp. xviii+300. (London: Longmans, Green, and Co., 1921.) 16s. net.

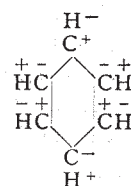
PROF. FRY bases his conception of valency on Sir J. J. Thomson's interpretation of the bond (without reference to the nature of chemical affinity or to the structure of the atom) as a unit Faraday tube. Such a bond is produced by the transference of an electron from one atom to another. Furthermore, each atom can both lose and gain electrons, or, in other words, can function as possessing positive and negative valency. Thus a univalent hydrogen atom may function in two ways, as H^+ or H^- ; a bivalent oxygen atom in

three ways, O^{++} , O^{+-} , O^{--} ; a tervalent atom in four ways; and a quadrivalent atom, such as carbon, in five ways.

On this simple foundation an elaborate system of valency has been built up. It follows from the above assumption that by the combination of two substances X and Y two compounds may be formed—namely, X^+-Y^- and X^--Y^+ . These are called electronic isomers, or electromers, and may form an equilibrium mixture. How are they distinguished? The author suggests that if water is composed of H^+-OH^- (though there appears to be no reason why it should not be H^--OH^+) a negative atom or group will attach itself to hydrogen, and a positive atom or group to OH^- .

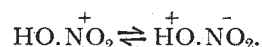
In this way the valency of atoms and groups is determined.

Passing on to part 2 of the work, which deals with aromatic compounds, the electronic formula for benzene is represented as follows:—



Upon this formula the various reactions of benzene, its physical and chemical properties, as well as those of its homologues and congeners, are based.

It would take up too much space to discuss part 2 in detail, and one or two examples must suffice. It is clear that where substitution takes place a negative atom or group will replace a negative H atom. Here a difficulty appears to arise, for in the case of substitution by chlorine there are two competing atoms in the molecule Cl^+Cl^- . This is met by formulating two electromers, $\text{C}_6\text{H}_5^+\text{Cl}^-$ and $\text{C}_6\text{H}_5^-\text{Cl}^+$. The author assumes that Cl^- enters the nucleus. It follows, then, that Cl^+ has to be satisfied with H^- , in which case it is to be presumed that the electromer of hydrogen chloride, H^-Cl^+ , is formed. Similarly with nitric acid, which may exist in equilibrium as



Here the author gives preference to the first formula, whereby NO_2^+ replaces electropositive hydrogen in the nucleus. After making these various, though not very convincing, assumptions,